



Pyrko, I., & Dörfler, V. (2014). SODA in qualitative research: Using cognitive mapping for analysing semi-structured interviews. In *British Academy of Management Conference*

Peer reviewed version

License (if available):  
Unspecified

[Link to publication record in Explore Bristol Research](#)  
PDF-document

## University of Bristol - Explore Bristol Research

### General rights

This document is made available in accordance with publisher policies. Please cite only the published version using the reference above. Full terms of use are available:  
<http://www.bristol.ac.uk/red/research-policy/pure/user-guides/ebr-terms/>

# **SODA in qualitative research**

## **Using cognitive mapping for analysing semi-structured interviews**

### **Summary**

We present the journey of one of the authors throughout his learning of SODA-style cognitive mapping for analysing semi-structured interviews. Our aim is to share the 'lessons learned' with the academic community interested in finding a suitable tool for formalised analysis of rich qualitative data. The technical side of cognitive mapping is emphasised focusing on the analytical capabilities of this approach rather than simply on drawing the initial cognitive maps. The purpose of the project is twofold: on the one hand we want to make this research method more accessible to those who may need it; on the other hand we want to put an end on some popular misconceptions about cognitive mapping being a simple (less often simplistic) but not very effective tool. We support our argument by drawing from the relevant literature and from the maps coming from empirical research conducted in the context of the NHS Scotland.

A full paper intended for the British Academy of Management 2014 conference in Belfast

Track: Research Methodology

Word count: 6966

*“Practice doesn’t make perfect. Perfect practice makes perfect.”*

*A tip of the day from the software Decision Explorer*

## **Introduction**

In this paper we write about cognitive mapping as an academic research method for analysing rich qualitative data, in particular semi-structured interviews, based on the maps constructed by one of the authors. The setting of his project was the NHS Scotland where the author explored how the concept of Communities of Practice (CoPs) was being operationalised. The focus of this discussion is not on the explicit findings of that particular study; instead, our aim is to draw from the ‘lessons learned’ of the process of becoming a ‘cognitive mapper’ in order to talk about the practicalities behind cognitive mapping as well as to discuss how it can potentially be useful for the academic community. We adopt a novice’s perspective (at the beginning of the developmental process) that is aimed at other novices (of cognitive mapping as a research approach, not necessarily novices of academic research in general) so that it may become easier for them to deal with the technical practicalities of learning the rules of cognitive mapping as outlined by the thought leaders in the area. In other words we intend to offer a paper that is both informative to anyone interested in the range of available research methods in the area of management organisations, and that would have made the life of one of the authors easier if he had had this paper when he was starting his journey with cognitive mapping. At the very early stage of involvement with cognitive mapping there are two basic problems that the novice cognitive mapper experiences: that it is easy and that it is hard, often at the same time. Drawing a map initially appears easy and the novices quickly jump to the conclusion that they can do it. Then they find out that these maps are not very good and then they think that drawing good maps is hard. Finally, when they figure out that drawing the nodes and arrows is only the first step, and that there are many other steps to take if they want to understand what the maps have to say, not many continue – particularly as they do not see the end-picture, i.e. when they will actually be able to produce something usable. Therefore in this paper we present a several months long journey from the very beginning to the stage when adequate analysis is conducted.

We believe that there are a number of reasons why reading this paper may perhaps be helpful. The SODA-style cognitive mapping, which is pursued in this study, is often used for strategy making in executive management teams where the participants intentionally negotiate their goals together. In this project, in contrast, the participants typically are not in the need of explicitly formulating their goals. The visual problem structuring is used here to support the exploration of the studied phenomena rather than as an aid for making strategy. Furthermore, whilst the available literature is not short of publications on using cognitive mapping, we assume that the specific setting of this study leads to some idiosyncratic insights which may potentially prove as a useful resource for learning about cognitive mapping as a research method. Lastly, we invite the reader to vicariously reflect on the key learning points stemming from one of the authors’ strivings for competence in cognitive mapping, many of which – quite understandably – centre on the unintentional mistakes and failures that serve as the basis for growth. In essence, we offer the readers the opportunity to learn from our mistakes rather than from their own.

The argument begins by briefly outlining how cognitive mapping as a technique has developed over the last decades. The SODA approach to cognitive mapping is introduced, along with the basic coding rules. Subsequently the empirical study in the NHS Scotland from which the maps used in this paper come from is described. This builds a foundation for

the discussion on the process of coding the maps within the mentioned study, and about what we can learn from analysing and interpreting the maps. Finally we conduct a discussion where we summarise the key learning points of one of the authors to develop his mapping skills, and we talk about the implications of using cognitive mapping in academic research.

### **SODA approach to cognitive mapping**

Cognitive mapping is a formal technique where a person's thinking about a problem is modelled using directed graphs (Eden, 1988). It should not be confused with the mind mapping technique developed by Buzan and Buzan (1995) and recently popularised by Web-based tools such as Spider Scribe, MindMeister, or Bubbl<sup>1</sup> that can produce similarly looking graphs. Whilst mind maps typically depict spontaneous networks of ideas portraying linkages to a central concept (Davies, 2011), the structure of cognitive maps emerges from the causal relationships of concepts represented by short phrases that are linked by unidirectional arrows (Eden et al., 1992). The term 'cognitive mapping' was first used by Tolman (1948) who intended to oppose the back-then dominating understanding of human as a stimulus-response processor of information (see Polanyi, 1962). The pioneering example of cognitive mapping as a technique can be traced back to Axelrod (1976) who used directed graphs to analyse the content of codified resources in the area of political science. Today we can distinguish among different approaches to cognitive mapping developed in various disciplines. For example, Self-Q (Bougon, 1992) and its modifications (Tegarden and Sheetz, 2003) use cognitive mapping in structured interviews. Another example, FCM incorporates fuzzy logic in cognitive mapping (Kosko, 1986, Özesmi and Özesmi, 2004, Vanwindekens et al., 2013). An essential consideration for all cognitive maps is that they do not result in a 'complete picture' of someone's cognition, rather they offer an imperfect representation of cognition that may perhaps be useful in thinking about a given problem. As noted by Eden (1992: 262):

*"(1) [cognitive maps] may represent subjective data more meaningfully than other models and so have utility for researchers interested in subjective knowledge, and (2) they may act as a tool to facilitate decision-making, problem-solving, and negotiation within the context of organizational intervention".*

The particular approach to cognitive mapping which we pursue in this paper is called SODA (Strategic Options Development and Analysis) developed by Eden and Ackermann (2009a), which has arguably 'made a career' in the field of management and organisations (and particularly in the area of operational research) since its early formulations (Eden et al., 1979, Eden et al., 1983). SODA is in fact a broader approach that has been developed for management consultants to aid their client groups in dealing with messy problems and cognitive mapping is a central technique to it (Eden and Ackermann, 1998). In effect for the purpose of simplicity every time we use the term 'cognitive mapping' here, we imply SODA-style cognitive mapping. According to Eden (1988) the key conceptual underpinning of SODA is the work of Kelly (1955) and his Theory of Personal Constructs. According to Kelly's theory people try to predict the future developments of the world around them by making sense of that world. They do so by contrasting and finding similarities ('I like chocolate ice cream more than strawberry ice cream'), by trying to explain why certain things have happened ('why have you decided to buy a car?'), and by hierarchically organising the meanings of the things that they know ('in order to achieve the goal of getting a good job in the future I need to gain relevant work experience, graduate from the University, and network

---

<sup>1</sup> See the websites: <http://www.spiderscribe.net/>, <http://www.mindmeister.com/>, <https://bubbl.us/>

with the professionals in my field'). As it should be seen in the subsequent discussion, Kelly's theory strongly influences how cognitive mapping is done in practice.

The rules of constructing cognitive maps have been refined over the years by Eden and Ackermann and their co-authors in many of their publications on the topic (Ackermann and Eden, 2011, Ackermann et al., 1990, Bryson et al., 2004). From these sources we can learn that in cognitive mapping a modeller constructs a directed graph based on their own thinking, or based on a written text, or based on an interviewee's accounts during an interview situation. The maps can be drawn on the sheets of papers, or they can be constructed on a flip chart using post-it-notes. Alternatively, as we have done in this paper, the specialised software Decision Explorer<sup>2</sup> can be used. In cognitive mapping an account of a problem is broken down into separate phrases of between 10-12 words which are formulated in an actionable form while also trying to retain the natural language of the original source. The *nodes* (concepts on the maps) are linked to each other using unidirectional arrows in order to mark their means-and-outcomes relationships. In this way it is possible to obtain a hierarchy of nodes (Figure 1), with the *goals* (outcomes that are 'good in their own right') at the top, *strategic issues* representing central and highly linked nodes (that will have considerable ramifications if we do not do anything about them), and *options* at the bottom (that may lead to alternative courses of action). This means that we can typically ladder up the map by asking 'why' questions (e.g. why do you want to do this), and we can ladder down the map by asking 'how' questions (e.g. how do you want to do this). It is also useful to add extra meaning to the nodes by including the opposing poles to the existing statements. This is expressed by placing '...' which stands for 'rather than' between the two poles inside a node. Consequently if we want to direct an arrow leading from a node to an opposing pole in a different pole, then we have to put a negative '-' sign next to it.

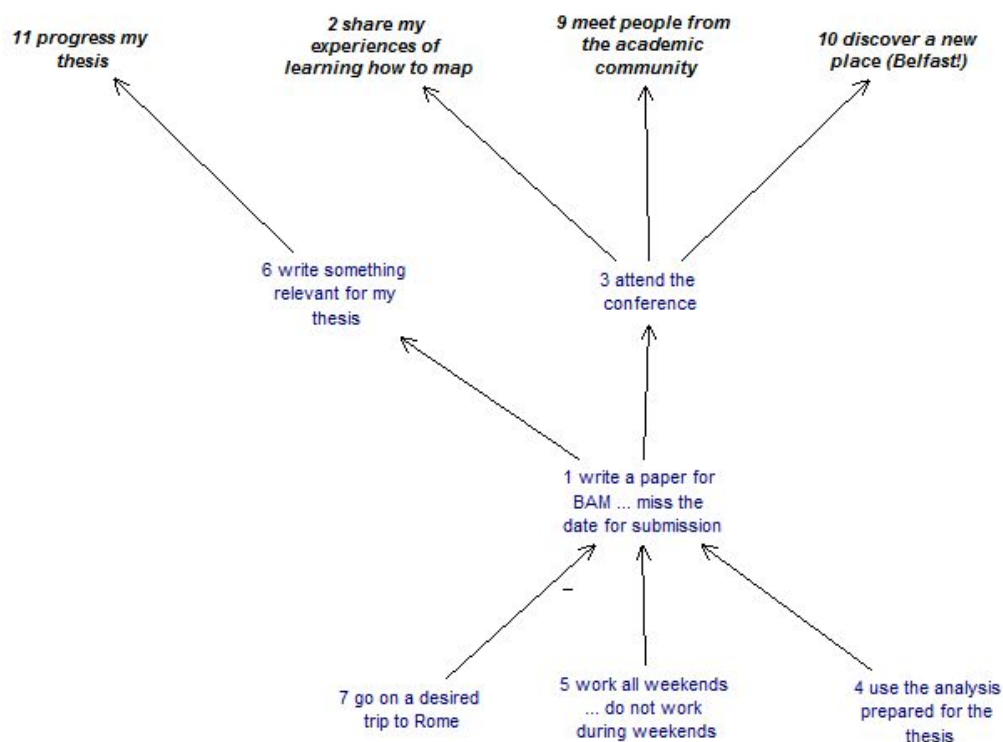
---

<sup>2</sup> <http://www.banxia.com/dexplore/>



**Figure 1: Guide to the node styles used in this paper**

For illustrative purposes of what a simple cognitive map looks like, one of the authors mapped why he had decided to write this paper (Figure 2). He first entered node 1 in which he stated what he wanted to do – in this case ‘write a paper for BAM rather than miss the date for submission’ (the nodes are numbered by default according to the order in which they are entered). The nodes leading to the node 1 explain how it could be achieved: by working all weekends rather not working during weekends (node 5), and by using the analysis prepared for his thesis (node 4). Note that there is a negative link coming from the node 7 to the node 1. This is because if he decided to go on a desired trip to Rome, he would most likely miss the deadline – the trip therefore had to wait until summer. Furthermore, by looking at the nodes above the node 1, we can see why he wanted to write the paper in the first place: to write something relevant for his thesis (node 6) and to attend the conference (3). These two nodes in turn lead to the main goals (i.e. outcomes good in their own right) of this endeavour: to meet people from the academic community (node 9) and to share his experiences of learning how to map (node 2). This simple model then presents the type of logic followed in cognitive mapping which can hopefully serve as a useful guidance for reading the other maps included in the subsequent sections.



**Figure 2: The purpose of this paper?**

### **Setting: empirical study in NHS Scotland**

As mentioned above, we conduct our discussion based on the maps constructed coming from one author's study in NHS Scotland. The study had a longitudinal character as it spanned over the period of 2 years in the form of action research, meaning that the researcher was actively providing advice to the practitioners whilst simultaneously attempting to inform his own theorising (Eden and Huxham, 1996). The aim of that study was to explore how the concept of Communities of Practice (CoPs) was being operationalised by healthcare practitioners. CoPs can be understood as groups of people who interact regularly because they share genuine interest in the same problems even if they do not belong to the same teams or organisations (Wenger, 1998); for example, when the IT officers from different departments in a company share their expertise and good fellowship on the day-to-day basis even though they technically do not work together. Perhaps due to the unofficial character of these groups, the concept of CoPs is often misunderstood or misinterpreted especially when the attempts are made of instrumentally setting up such groups in a top-down manner (Amin and Roberts, 2008, Wenger et al., 2002), and as a result various problems surrounding the concept of CoPs in organisations tend to be very messy. This in turn can make a case for a very good opportunity to apply the cognitive mapping technique.

The researcher's main contact within the NHS Scotland was the NHS Education for Scotland<sup>3</sup> (NES), which is a special health board that organises training for healthcare practitioners, administers the online libraries and repositories, and is responsible for the matters surrounding Knowledge Management. Due to the relevance of CoPs to NES'

<sup>3</sup> See the website: <http://www.nes.scot.nhs.uk/>

operations, its managers were interested in assigning the researcher to various parts of the NHS Scotland where various projects dedicated to developing CoPs were undergoing. His aim was to explore the possibilities of making those communities better, to see if they were facing any problems, and simultaneously to gain hopefully valuable material for his project. He consequently conducted 25 semi-structured interviews with practitioners from the areas of sepsis and dementia, as well as with staff from the NES. Apart from that he attended numerous formal meetings and he analysed the relevant codified material. The selected interview material gathered in this study will now serve for the rest of our discussion.

### **Drawing the maps: coding the interviews**

In the study on Communities of Practice (CoPs) in NHS Scotland, cognitive mapping was used to map the semi-structured interviews with the expectation that it would allow to add more rigour and clarity to thinking about the messy problems surrounding CoPs, such as the issues of knowledge and learning across functional teams, organisational politics, or culture. There are typically two variants of SODA mapping which the author of the study could have potentially chosen from (Bryson et al., 2004). One option, called oval mapping, is to invite the participants to construct the maps together as a group in a ‘real-time’ session. This, however, was not possible because the participants of the study were working in different hospitals and hence they were scattered across different parts of Scotland. The author therefore followed the other variant, where the modeller firstly does the individual maps with each participant, and only then the constructed maps are merged into one map.

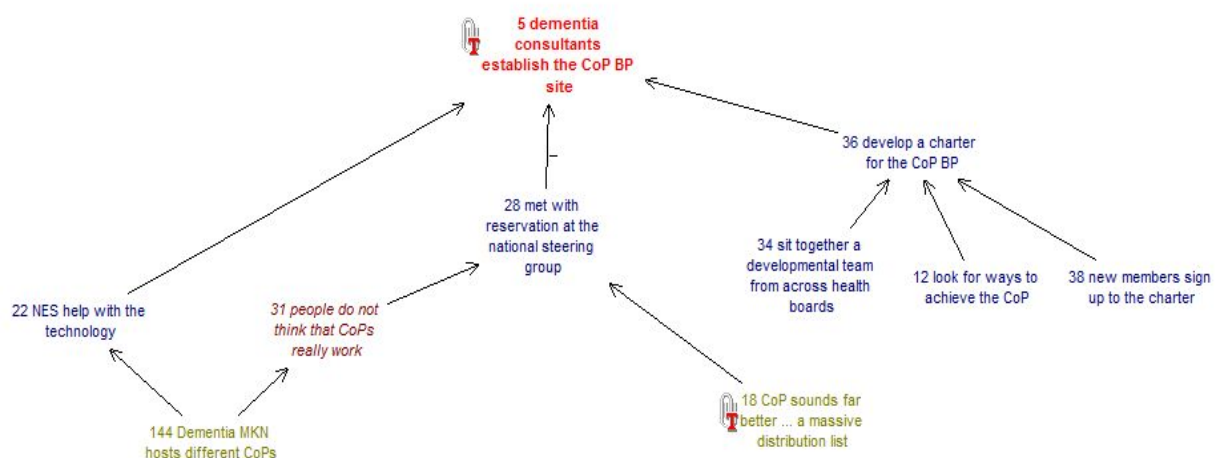
When the researcher started doing the interviews he was assuming that at some point he would use cognitive mapping for analysing the gathered material, but he had not planned ahead how he would construct the maps and how to validate them. Because he would often do a series of interviews in a row, and because he was doing the full transcriptions before he was mapping the interviews, he sometimes ended up coding the interviews weeks after they had happened. That was not in line with the typical mapping convention suggesting that the maps should ideally be done in real time because it allows the modeller to ask questions in a reflexive way with regards to the map as it emerges during the conversation (Bryson et al., 2004). Even though the map tends to be very messy at that point, it can indicate the gaps or inconsistencies in the interviewee’s argument, or things that the interviewee is not clear about, or things that the interviewer does not understand. Consequently such gaps can prompt the interviewer to ask relevant questions that might have not been asked otherwise.

As a form of illustration Figure 3 represents a fragment of a map from the first interview in this study. The interviewee was a National Dementia Consultant who wanted to develop a CoP called ‘Best Practice’ (hence ‘CoP BP’ in the node) in her area of expertise. She thought that a good way of doing that was to establish a dedicated website (node 5). The nodes leading to the node 5 explain what actions the interviewee thought it would take to set up the CoP website: to develop a charter (node 36), to receive help with the technology from the NES (node 22), and to assert that ‘CoPs sound far better rather than a massive distribution list’ (node 18). Furthermore there is also a negative link leading to the node 5 which says ‘met with reservation at the national steering group’, and which is in turn caused by the statement ‘people do not think that CoPs really work’ (node 31).

The problem with this part of the map is that the only sufficiently elaborated statement is ‘develop a charter’ (node 36), as it is supported by three different actions: ‘sit together a developmental team...’ (node 34), ‘look for ways to achieve the CoP’ (node 12), and ‘new



members sign up to the charter’ (node 38). At the same time, it somewhat lacks the explanations with respect to what else it might take to establish the CoP site (node 5) apart from the nodes 18, 22, 28, and 36. For example: what kinds of practitioners were expected to participate in that community, or how did the community’s leaders want to find and to invite the first members? Moreover it would be very interesting to know what exactly underpins the statements ‘people do not think that CoPs really work’ (node 31) and ‘CoP sounds far better...’ (node 18). Again, it would arguably have been much easier to spot those gaps and to ask the necessary questions if the researcher had been coding the map during the interview situation – meaning the interviewer could have made more out of the interview. Interestingly, the emerging map can serve as a structure that can replace the interview guide, and the coding process literally forces the interviewer to listen very carefully to the interviewee which in itself can often be an exhausting and uneasy task (Bryson et al., 2004).



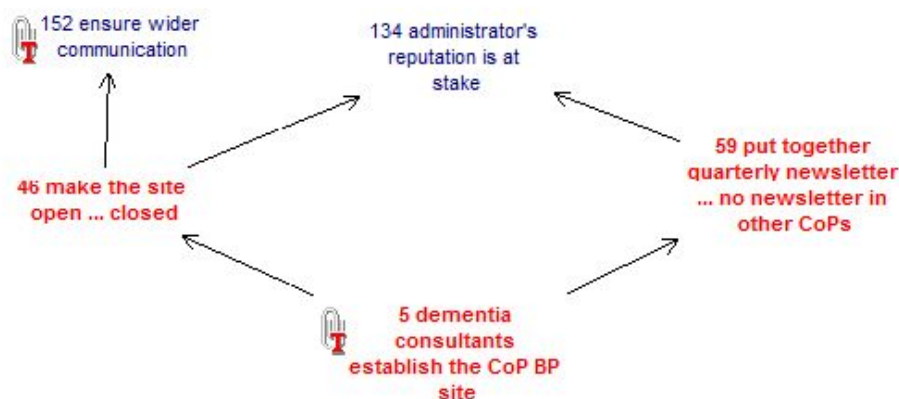
**Figure 3: What does it take to set up a community of practice site?<sup>4</sup>**

Another difficulty is that the researcher should have ideally met with each of the interviewees within the week of the interview to review the content of the map, unless this can be done during the interview (Bryson et al., 2004). Since in this case a longer period of time passed before the interviewees could see the map, they may not be able to recall that well everything that was said in the interview, in effect making the validation process problematic. Moreover the interviewee’s help may be particularly needed in situations when the modeller finds it challenging to judge whether the statement ‘A’ is the means to the statement ‘B’ and not its outcome or vice versa. This is usually a non-trivial question as it can considerably change the meaning of the map. For example Figure 4 shows the results of setting up the CoP website (node 5): making the site open to everyone rather than exclusive only to the members (node 46) and putting together a quarterly newsletter which is not available on the other CoPs (node 59) – and they in turn result in ensuring wider communication (node 152) and in

<sup>4</sup> The paperclip symbol next to the nodes 5 and 18 signify additional notes that can be added to the model in the software Decision Explorer. Such notes can include the detailed information about the empirical material which is not contained on the map. We do not explicitly show here their content because they are not relevant for this paper. Also, the Dementia MKN in the node 144 stands for ‘Managed Knowledge Network’, see: <http://www.knowledge.scot.nhs.uk/dementia.aspx>

putting administrator's reputation at stake (node 134). In this example it seemed quite evident with respect to the broader interview context that the Dementia Consultants had actually wanted to set up the CoP website mainly as the means to publishing a newsletter about dementia rather than to use the newsletter as the means to advertise and support the CoP website (which reflects on the respective direction of the arrows on the map). However whilst this can be a potentially very useful finding, it would require further validation with the interviewee.

It may also sometimes actually be necessary to code the interview post factum (e.g. when using the prior recorded material, or when coding someone else's interview). Based on the experiences of the researcher of this study we suggest working with the audio or video recording without stopping rather than coding from the transcript. The reason for this is because it allows the modellers to immerse themselves into the recorded conversation, and pay attention to the non-verbal cues (such as the tone of voice) which then can be helpful in identifying the possible goals and issues. It also gives an opportunity to practice coding in 'real time' which can be a helpful exercise before the subsequent interviews.



**Figure 4: What results from setting up the community website?**

What may be misleading about learning cognitive mapping is that it may seem very easy and intuitive at the outset because one can simply start entering the nodes and connecting them together. Nevertheless if one does not follow the coding conventions (Ackermann et al., 1990) then one can easily end up with a map which is not very useful and not amenable to analysis. As suggested by Eden et al. (1992), the inexperienced modellers often create maps that have too many links and too few nodes. For example in the first attempts to produce the maps for his study, the first author of this paper was mapping roughly 35 nodes per hour of interview, whilst after reworking his maps twice from scratch and considerably revisiting the relevant literature he was coding on average 70-100 nodes per hour (we compare these two maps later). The explanation for this can be that the inexperienced modellers do not code what they do not consider to be relevant, and that they bundle a number of concepts together under one generic node that represents them all. Such approach makes the map less useful because the very purpose of the map is to represent the problem in its full richness – the map should serve to better understand the problem without losing on its complexity (Eden, 2004). If one is able to note down the summary of the whole interview in 35 nodes, then the need for using cognitive mapping becomes questionable since one could as well do the analysis in one's mind. That is not to say that the nodes with the same meanings should not be merged (e.g. 'set up a community website' and 'establish a community page'), but one must be very

careful to ensure that the merged nodes really mean the same thing (especially if the merged nodes are coming from different interviewees).

When coding the map it is also important to maintain the natural language of the interviewee. The risk is that one can end up with the map that represents the modeller's thinking rather than that of the interviewee, meaning that the map does not pay justice to the empirical material (Ackermann et al., 1990). The author of this paper had fallen into this trap at the first attempt of coding his interviews and as a result he had to start the entire mapping process from the beginning. Furthermore, it is advisable to avoid duplicating the links when it is not necessary (Bryson et al., 2004). For example on Figure 4 the links would be duplicated if there was a link coming from the node 5 to the node 152 because the node 5 is already connected with the link 152 through the node 46 within the same chain of argument. In some situations a modeller may be tempted to include such links, however adding too many links may bias the analysis of the map – which we talk more about in the following section .

### **Learning from the maps: analysing the interviews**

The extent of how much we can learn from the maps is highly effected by whether we appropriately follow the mapping conventions (Ackermann et al., 1990), particularly if we expect to conduct the type of analysis that is informed by them (Eden, 2004, Eden et al., 1992). We illustrate this assertion by comparing two different versions of the map prepared for the same interview from the NHS Scotland study. We include Figure 5 and Figure 6 to specifically discuss the *shape* rather than the *content* of these maps because the shape emerges from the relationships within the content and hence it can be a good starting point for analysing the maps. We will also occasionally 'zoom into' the maps to provide more detail in places where it is needed.

The map on Figure 5 clearly fails to adhere to the mapping conventions, and the map on Figure 6 was done after the researcher had revisited the relevant literature about cognitive mapping having understood that his initial maps had not been sufficiently good quality. The map on Figure 5 contains fewer (read too few) nodes and it also does not adopt the 'teardrop' structure (Figure 7); in 'teardrop' the most specific actions are positioned at the bottom of the map, subsequently leading upwards to the central and highly linked issues, and finally ending with the goals at the top of the map. The advantage of following the 'teardrop' structure is that it can make it easier to track the alternative bundles of action that can lead to completing the more generic actions – as for example when we were discussing what actions it took to establish the CoP website on Figure 3. Since the map on Figure 6 does follow the 'teardrop structure', we can start interpreting it without even reading its content, and we can compare its shape with the shape of the other maps which follow the same type of mapping logic. Here we can observe that the map on Figure 6 is rather narrow, and there are few 'heads' (i.e. nodes which do not lead to any other nodes) at the top. This can indicate an idealistic thinking about the problem where only one or a few outcomes are considered, and which lacks clearly distinct and elaborate courses of actions that could support each of those goals. We can see this on Figure 8 which shows the top of that map in more detail: it ends only with two closely positioned heads, i.e. the node 172 ('help people with Dementia with practical problems') and the node 171 ('prove we need more Allied Health Practitioners'). It is worth noting that the map which represents an idealistic thinking about the problem does not represent a type of thinking that is inherently correct or incorrect, but it is simply an initial observation that can be used for further exploration of the content of the map. The same map is also quite flat at the bottom with many tails (nodes without any links directed into them), which can indicate

detailed assumptions about the background of the problem (Figure 9 shows a broader view on some of those detailed assumptions). If we compare this map with the map from the second interview (Figure 10) which was conducted with a healthcare practitioner from the area of sepsis, then we can see that the different courses of action on that other map are somewhat more elaborated and that there is a bigger number of heads at the top. Again, these are examples of potentially interesting observations that can merely serve as a resource for further analysis and discussion.

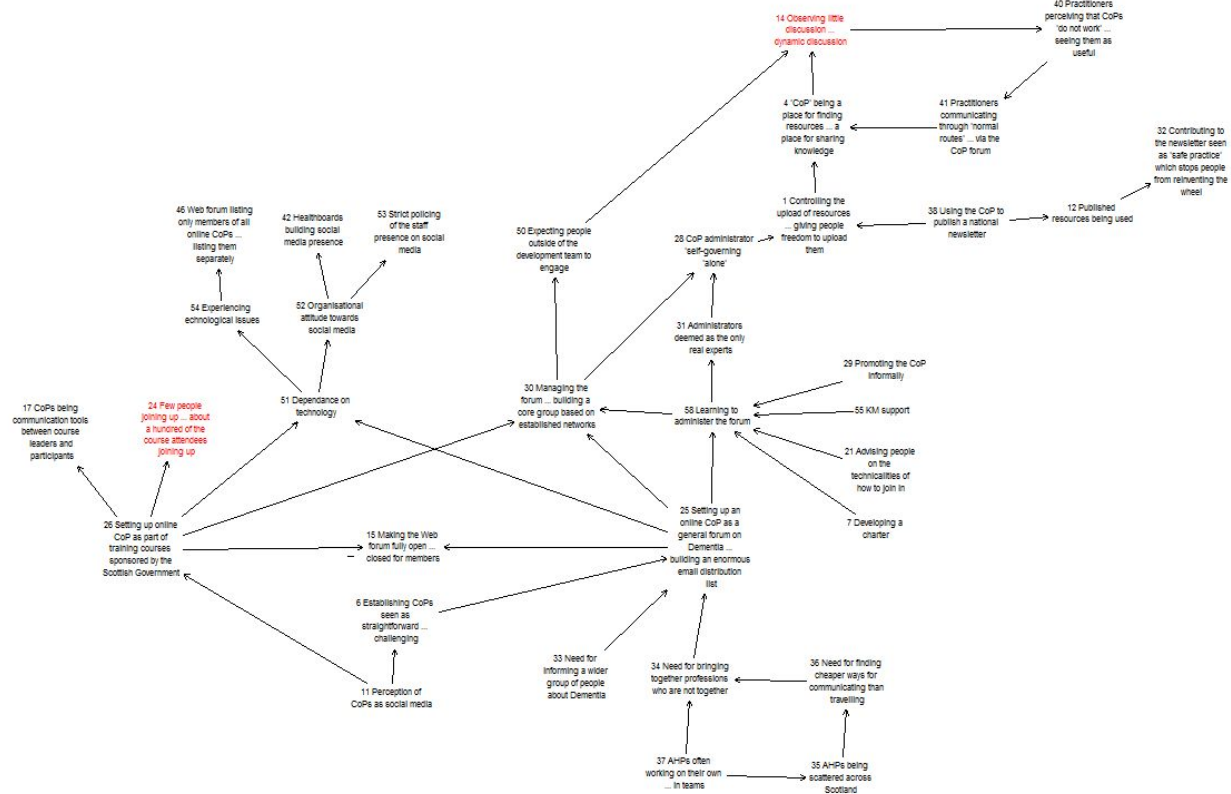


Figure 5: The shape of the first version of the map from the first interview

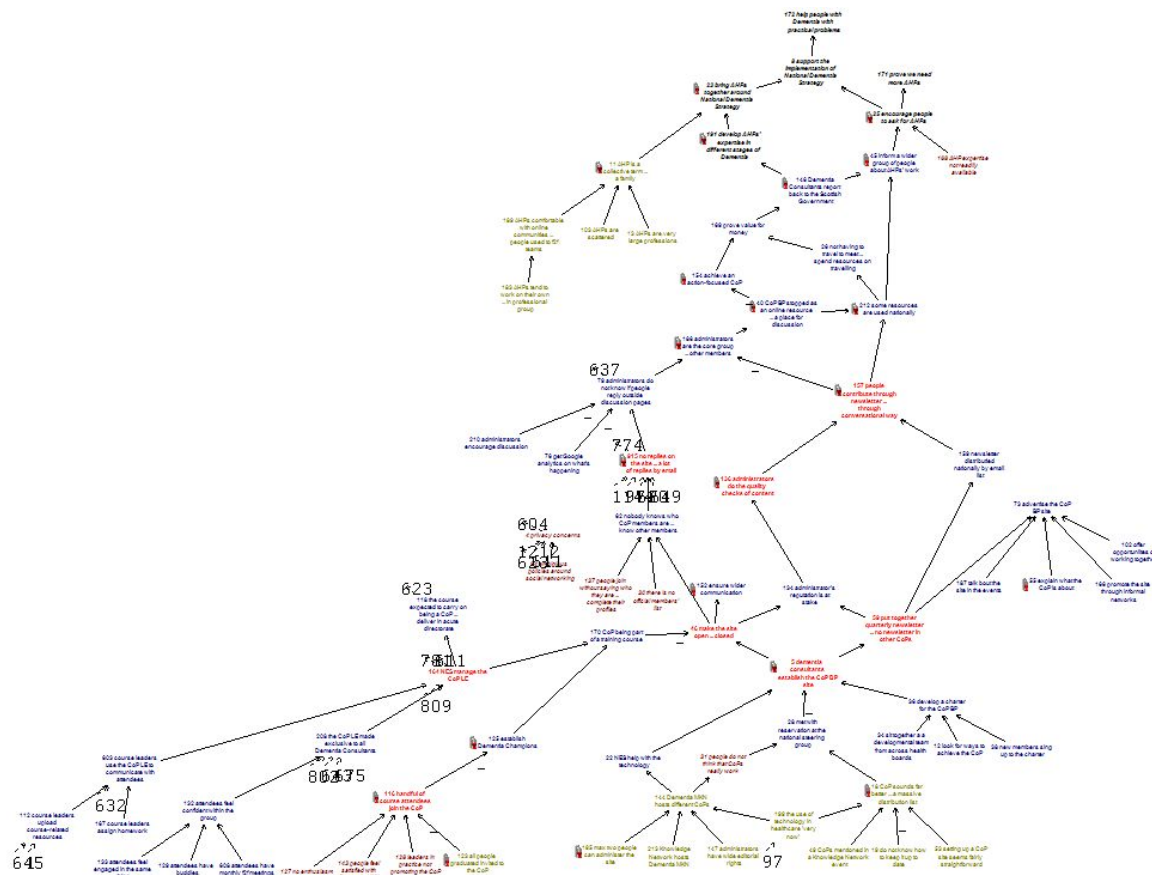


Figure 6: The shape of the final map from the first interview

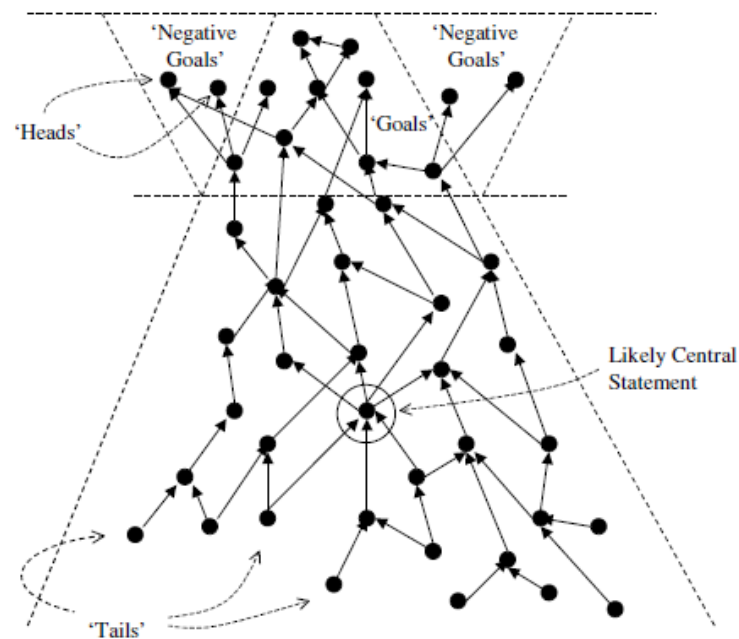


Figure 7: The 'teardrop' structure of cognitive maps.

Direct source: (Eden, 2004: 676)

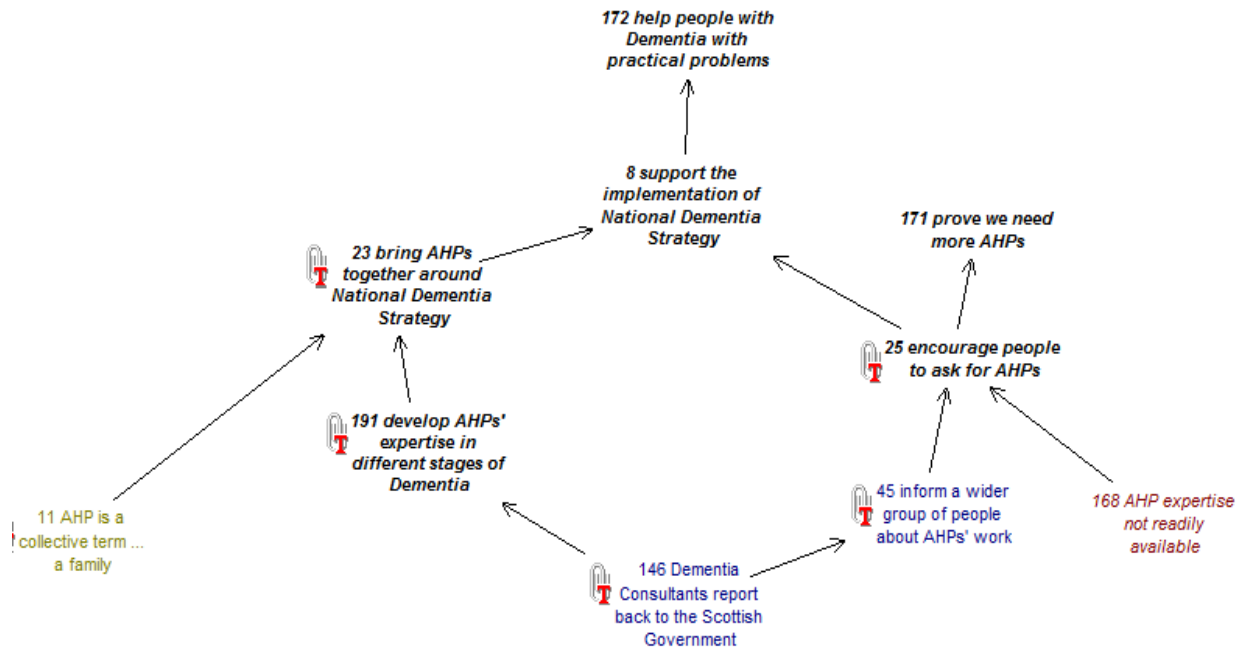


Figure 8: The goals from the first interview<sup>5</sup>

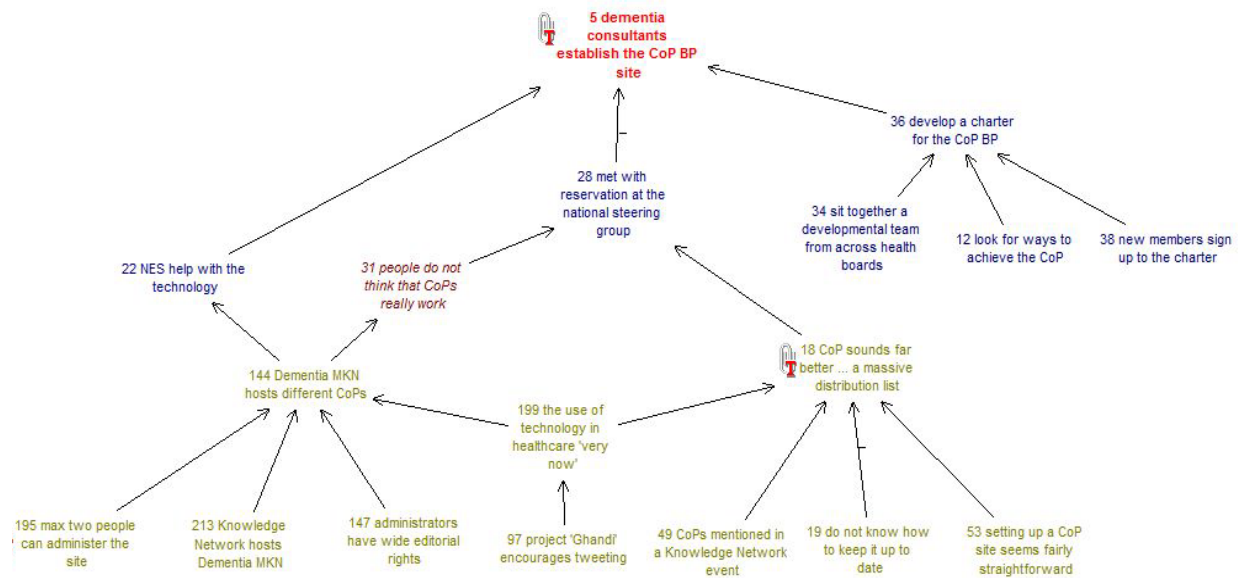
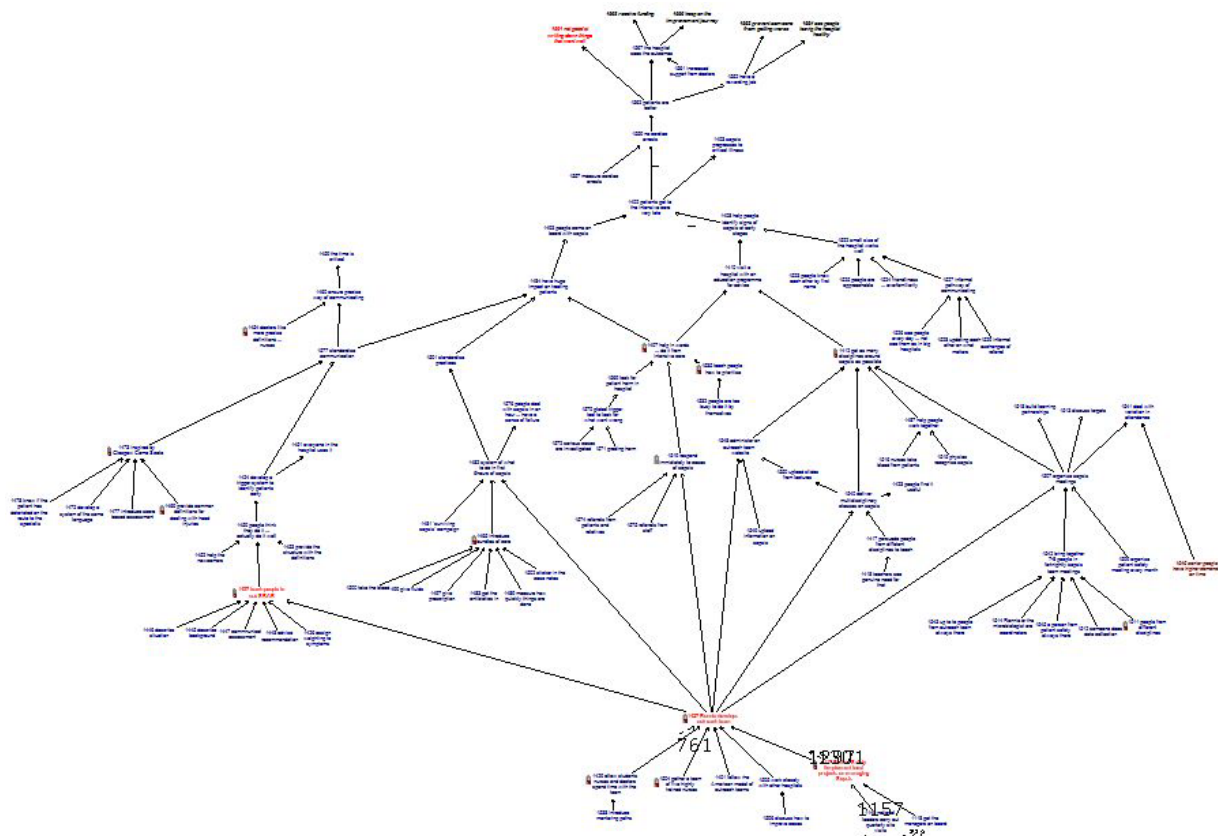


Figure 9: The 'tails' from the first interview

<sup>5</sup> 'AHP' stands for 'Allied Health Professionals': <http://www.scotland.gov.uk/Topics/Health/NHS-Workforce/Allied-Health-Professionals>





**Figure 10: The shape of the map from the second interview**

After the first author had coded the maps and gained some initial insights simply from comparing their shapes, he decided to merge the individual maps together (note that if one is doing this in Decision Explorer software then it is necessary to save the model prior to merging the maps because many of the changes cannot be undone). He did this by bringing the layouts of the respective maps into the same view (i.e. a window in the software that is used to look at the selected parts of the model) where he merged together the nodes coming from different interviews when it was safe to assume that they referred to the same underlying meaning (e.g. ‘promote the community website’ and ‘advertise the community website’), and he made the links between the maps where such links were also clearly stemming from the interviews (e.g. particularly when the interviews were discussing the same topics or issue in a similar way). However he found that the approach of merging the maps in a single view was cumbersome and confusing because of the high number of nodes that were dumped into it. As a result he decided that it was easier to merge the maps whilst working in separate views (i.e. each view representing a different person) rather than in one ‘big view’. The logic of merging the nodes was exactly the same, as the main idea was still to look for the commonalities between the maps.

The reason why it was necessary to merge the maps rather than to conduct the analysis on the individual maps separately was because only then it was possible to gain insight into the ‘emerging properties’ (i.e. the hierarchies and the linkages) of the whole model (i.e. all of the interviews brought together) and not merely of the separate maps (as it would make sense in other qualitative research methods). The merged model can be very big – for the purposes of this paper it proved sufficient to merge only 5 out of 25 interviews from the NHS in Scotland study and the final model still consisted of 402 nodes. It is particularly when working with

such large models that the cognitive mapping method offers us potentially powerful analytical capabilities (especially if we use specialised software, such as Decision Explorer). Because of that it was essential for the researcher to become familiar with making use of different views in order to look at the whole model from multiple and concurrently more manageable angles. The main purpose of the analysis is to better understand from the perspective of the interviewees which concepts are central to the problem, to identify the main themes relevant to the problem, and to make the complexity and the size of the map easier to manage by simultaneously retaining both its size and its complexity (Eden, 2004, Eden et al., 1992).

One type of analysis performed in the NHS Scotland study was to calculate in the Decision Explorer software the possible key issues from the interviews by ranking the previously coded nodes according to their numbers of inward/outward links; this is called *domain analysis* (Figure 10). Another useful built-in algorithm is calculating the wider impact of the nodes on the map; this is called *central analysis*. It was then possible to obtain an overview of these key issues by opening a new view and by hiding all the other non-issues (using the collate option). Furthermore the author used the software to create the clusters of nodes that were closely interlinked, which in turn was helpful in identifying the relevant *themes*, such as ‘organisational culture’ or ‘application of technology’.

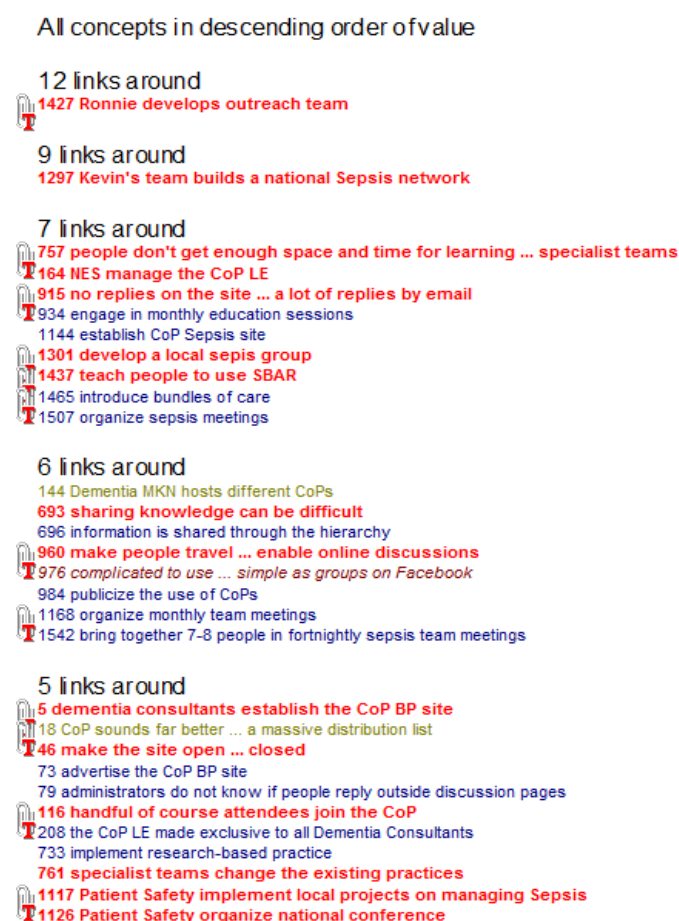


Figure 11: Domain analysis performed on the merged maps<sup>6</sup>

<sup>6</sup> Once the domain analysis was performed, the researcher used his judgment to apply the style ‘issues’ to the selected nodes with high domain score. It is typically to use this in conjunction with other available types of analysis, for examples the mentioned central analysis.



The researcher also conducted *loop analysis* which enabled him to identify vicious and virtuous circles based on the empirical material. Importantly, many such loops might not be otherwise easily identified. The loops are important because they directly point to the situations which can be self-reinforcing and which can have considerable consequences (Eden, 2004, Eden et al., 1992). For example on Figure 12 we can see one of the loops generated from the merged model. It describes a situation where the representatives of the NHS Education for Scotland (NES) were trying to develop a Community of Practice (CoP) that would be supplementary to a leadership course for healthcare practitioners holding senior positions. The course was sponsored by the Scottish Government, and the central part of the interactions of the CoP-to-be members (who were simultaneously attending the training course in question) was supposed to be a dedicated online forum. By reading the loop we can clearly see the vicious circle in which the respective parties found themselves in: the course attendees were more likely to communicate by email rather than on the CoP forum, leading to the administrators of the CoP website not knowing if people were replying to each other outside of the forum, leading to the course attendees being called to the Minister to explain why they did not use the dedicated CoP forum, leading to the course attendees not trusting the CoP forum, leading to the course attendees using the forum to ask general questions but not to formulate their own opinions, which in turn brings us back to why the course attendees were more likely to communicate by email rather than on the CoP forum. By getting a clearer overview of such problematic situations we can then further reflect on them whether to stop or to further reinforce them and potentially arrive at some interesting insights.

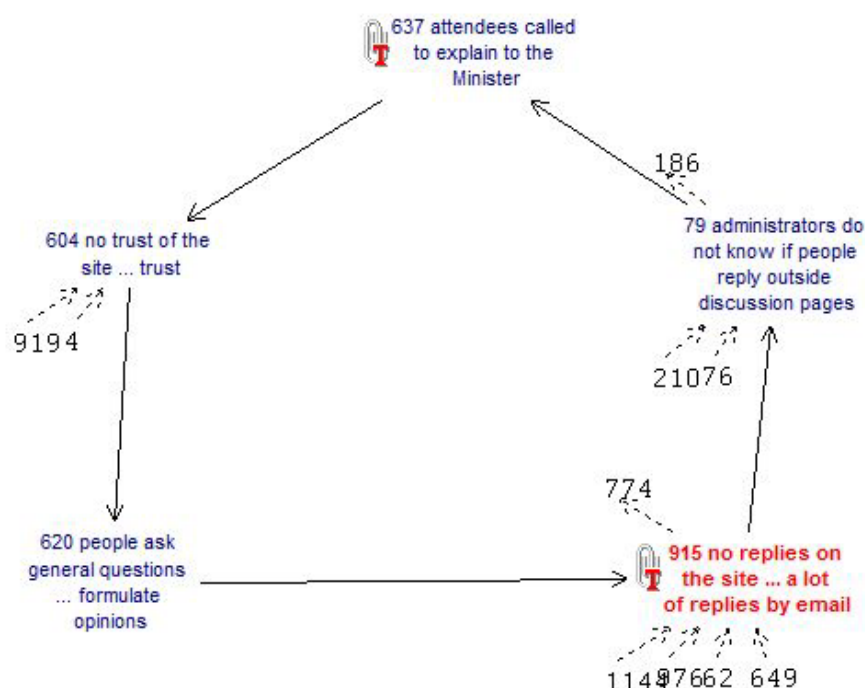


Figure 12: A loop from the merged map

### Some recommendations

Perhaps the biggest trap into which the first author of this paper had fallen into when trying to develop his mapping skills was that he had initially assumed that cognitive mapping was a straightforward word-and-arrow diagram that could be learned intuitively. He inevitably

discovered the hard way that cognitive mapping, like any other research method, required thorough understanding of the rules by which it was governed. The maps which were not guided by those rules were not found to be of much use for his study and therefore all of them had to be repeatedly reworked after carefully revisiting the literature on SODA-style mapping. The tricky question was, however, that it was not entirely clear from which sources to actually start his readings. For example perhaps the most popular publication where SODA-style cognitive mapping has been applied extensively is the book by Ackermann and Eden (2011) which nonetheless seems to be more suitable for the more advanced stages of learning rather than for the novice mappers (and which, in fact, is more about strategy making than about cognitive mapping). The difficulty is that it may perhaps not always be easy for the thought leaders in the area to recommend the sources for the novices because of their tacit understanding developed over the years of practice (i.e. they may know it in terms of the ‘big picture’ rather than in terms of the basic issues and details of technical nature that a novice may be facing) – this, in turn, was the main inspiration for this paper. The categorisation of the sources into the ones which proved ‘good to learn the basics’ was a non-trivial task, but based on the authors’ experience during this study, with one of them learning cognitive mapping from ‘zero’, we suggest starting with the following more foundational sources: Eden (1988, 1992, 2004), Eden and Ackermann (2009b), Eden et al. (1992), Ackermann et al. (1990), and Bryson et al. (2004). Subsequently one can venture into more advanced sources which tend to assume that one understands the basics, such as Eden (1994), Eden and Ackermann (2000, 2013), and Ackermann and Eden (2005, 2011). Apart from learning the cognitive mapping as a method, it may be very useful to familiarise oneself with the specialised software tool for cognitive mapping ‘Decision Explorer’. The reason for this is that on the one hand the software can make the mapping process much more efficient, and on the other hand by learning about the tool one can arguably simultaneously gain deeper understanding of cognitive mapping as a method. For this purpose the Banxia<sup>7</sup> (the Decision Explorer’s producer) website offers numerous training resources. After reading them it can also be a good idea to go through the Help file in the software, and to print off for one’s own reference the list of software commands which is also included there.

It appears to be the key priority for novice learners of cognitive mapping to accept the mindset that the role of the mapper is to listen very carefully to the interviewee and to try to be as faithful to the original material as it is possible. The mapper therefore should try to code what the interviewee is saying without paraphrasing or summarising this content, as well as to capture as much material as possible in the form of short statements that retain the natural language of the interviewee – only then can the interviewee feel the sense of connection with the map. The researcher should also keep in mind that the map is merely a tool – a simplified and imperfect visual representation of the interviewees’ thinking. Nevertheless there can be numerous benefits to reap for those who decide to learn this research method. By literally forcing the interviewer to listen carefully to the interviewee, cognitive mapping helps to ensure that the researcher understands what the interviewee is talking about. Furthermore it allows the researcher to give more structure and rigour to their own thinking about the collected empirical material, and to enquire into the gaps in the discussed chains of arguments which thereby become more evident. Cognitive mapping can also serve as a feedback tool by which the interviewee can see the outcome of the interview, and which can become particularly productive when a group of interviewees reflect on the merged map constructed from their individual conversations. Lastly it may be worth mentioning that the SODA-style cognitive mapping has so far been most often applied by consultants to aid the teams of executive managers with their processes of strategy making (Ackermann and Eden,

---

<sup>7</sup> See the website: <http://www.banxia.com/dexplore/>

2011, Eden and Ackermann, 1998). Based on our experience we argue that this method is similarly well suited for the academic work because even if the interviewee does not explicitly think about any strategic goals, then sooner or later some sort of goals or outcomes with regards to the discussed problem will naturally emerge from the conversation. Furthermore Decision Explorer can be used in the academic work for building the argument in conjunction with the NVivo software that can then be used for testing that argument, as for example applied by Page (2009). Having said that we note that the application of SODA mapping in the academic projects is under-researched and therefore a direction for future research may be to further explore how cognitive mapping can be applied within this context.

## Conclusion

Whereas the SODA-style of cognitive mapping has been around for a longer time, it seems that there still remains a large potential for its use in the broader area of organisational studies. A major reason why some people may be discouraged from using this method in their own work is that it may sometimes appear difficult to find a good place to start the process of learning how to map and how to deal with the issues of purely technical nature which every novice member needs to face sooner or later. Throughout this discussion we have demonstrated how these problems can be addressed and we tried to lower the 'entry barriers' for novice mappers by reflecting on a novice mapper's genuine learning experiences. We hope that these experiences can serve as a resource for learning, especially that many of them have been based on the actual mistakes that we would wish for anyone concerned to also be able to learn from.

Cognitive mapping is above all a very flexible research method that can aid a researcher in structuring messy problems, in tuning the attention to the interview situation, and in reflecting on a person's thinking. It is very well suited for working with groups of people as it enables the participants to see what the others are thinking, and thereby it supports them in thinking together. This method can also offer potentially powerful options for the analysis which can allow a researcher to easily cope with large volumes of qualitative material. For these reasons cognitive mapping is certainly worth trying by researchers working with rich qualitative verbal data but also focusing on non-verbal data, such as in the ethnographic or phenomenological studies. Steve Jobs famously said in his Stanford speech that in the matters of the heart one would know when one would find it. Similarly we would like to hope that for some of our readers we can at least offer an opportunity to stop for a while and to reflect on a research method that they may not have been aware of until now, whilst for some others to offer an inspiration for discovering a research method that might perhaps prove beneficial and rewarding when applied in the context of their own work.

## References

- ACKERMANN, F. & EDEN, C. 2005. Using Causal Mapping with Group Support Systems to Elicit an Understanding of Failure in Complex Projects: Some Implications for Organizational Research. *Group Decision and Negotiation*, 14, 355-376.
- ACKERMANN, F. & EDEN, C. 2011. *Making Strategy: Mapping Out Strategic Success*, London, UK, SAGE Publications.
- ACKERMANN, F., EDEN, C. & CROPPER, S. 1990. *Cognitive mapping - a user's guide*. Glasgow, UK: University of Strathclyde.

- AMIN, A. & ROBERTS, J. 2008. Knowing in Action: Beyond Communities of Practice. *Research Policy*, 37, 353-369.
- AXELROD, R. 1976. *The Structure of Decision*, Princeton, NJ, USA, Princeton University Press.
- BOUGON, M. 1992. Uncovering cognitive maps: the 'Self-Q' Technique. In: MORGAN, G. (ed.) *Beyond Method: A Study of Organizational Research Strategies*. New York, NY, USA: Sage.
- BRYSON, J. M., ACKERMANN, F., EDEN, C. & FINN, C. B. 2004. *Visible Thinking - Unlocking Causal Mapping for Practical Results*, Chichester, UK, John Wiley & Sons.
- BUZAN, T. B., B. 1995. *The Mind Map Book: Radiant Thinking - Major Evolution in Human Thought*, London, UK, BBC Books.
- DAVIES, M. 2011. Concept mapping, mind mapping and argument mapping: what are the differences and do they matter? *Higher Education*, 62, 279-301.
- EDEN, C. 1988. Cognitive mapping. *European Journal of Operational Research*, 36.
- EDEN, C. 1992. One the nature of cognitive maps. *Journal of Management Studies*, 29, 261-265.
- EDEN, C. 1994. Cognitive mapping and problem structuring for system dynamics model building. *System Dynamics Review*, 10, 257-276.
- EDEN, C. 2004. Analyzing Cognitive Maps to Help Structure Issues or Problems. *European Journal of Operational Research*, 159, 673-686.
- EDEN, C. & ACKERMANN, F. 1998. *Making Strategy: The Journey of Strategic Management*, London, UK, Sage Publications.
- EDEN, C. & ACKERMANN, F. 2000. Mapping Distinctive Competencies: A Systemic Approach. *The Journal of the Operational Research Society*, 51, 12-20.
- EDEN, C. & ACKERMANN, F. 2009a. SODA - Journey Making and Mapping in Practice. In: ROSENHEAD, J. & MINGERS, J. (eds.) *Rational Analysis for a Problematic World Revisited*. 2nd ed. Chichester, UK: John Wiley & Sons.
- EDEN, C. & ACKERMANN, F. 2009b. SODA - The Principles. In: ROSENHEAD, J. & MINGERS, J. (eds.) *Rational Analysis for a Problematic World Revisited*. 2nd ed. Chichester, UK: John Wiley and Sons.
- EDEN, C. & ACKERMANN, F. 2013. Problem structuring: on the nature of, and reaching agreement about, goals. *EURO Journal on Decision Processes*, 1, 7-28.
- EDEN, C., ACKERMANN, F. & CROPPER, S. 1992. The analysis of cause maps. *Journal of Management Studies*, 29, 309-324.
- EDEN, C. & HUXHAM, C. 1996. Action Research for Management Research. *British Journal of Management*, 7, 75-86.
- EDEN, C., JONES, S. & SIMS, D. 1979. *Thinking in Organizations*, London, UK, The Macmillan Press Ltd.
- EDEN, C., JONES, S. & SIMS, D. 1983. *Messing about in problems*, Oxford, England, Pergamon Press.
- KELLY, G. 1955. *The Psychology of Personal Constructs*, New York, NY, USA, Norton.
- KOSKO, B. 1986. Fuzzy cognitive maps. *International Journal of Man-Machine Studies*, 24, 65-75.
- ÖZESMI, U. & ÖZESMI, S. L. 2004. Ecological models based on people's knowledge: a multi-step fuzzy cognitive mapping approach. *Ecological Modelling*, 176, 43-64.
- PAGE, K. 2009. *Unlocking engagement : building cooperation and social capital using procedural justice* PhD, University of Strathclyde.
- POLANYI, M. 1962. *Personal Knowledge*, Chicago, USA, The University of Chicago Press.

- TEGARDEN, D. P. & SHEETZ, S. D. 2003. Group cognitive mapping: a methodology and system for capturing and evaluating managerial and organizational cognition. *Omega*, 31, 113-125.
- TOLMAN, E. C. 1948. Cognitive maps in rats and men. *Psychological Review*, 55, 189-2028.
- VANWINDEKENS, F. M., STILMANT, D. & BARET, P. V. 2013. Development of a broadened cognitive mapping approach for analysing systems of practices in social-ecological systems. *Ecological Modelling*, 250, 352-362.
- WENGER, E. 1998. *Communities of Practice: Learning, meaning and identity.*, Cambridge, UK, Cambridge University Press.
- WENGER, E., MCDERMOTT, R. & SNYDER, W. M. 2002. *Cultivating Communities of Practice*, Boston, Massachusetts, Harvard Business School Press.